Process Capability, Control, and Improvement Clause Allows Enhanced Process Monitoring and Control

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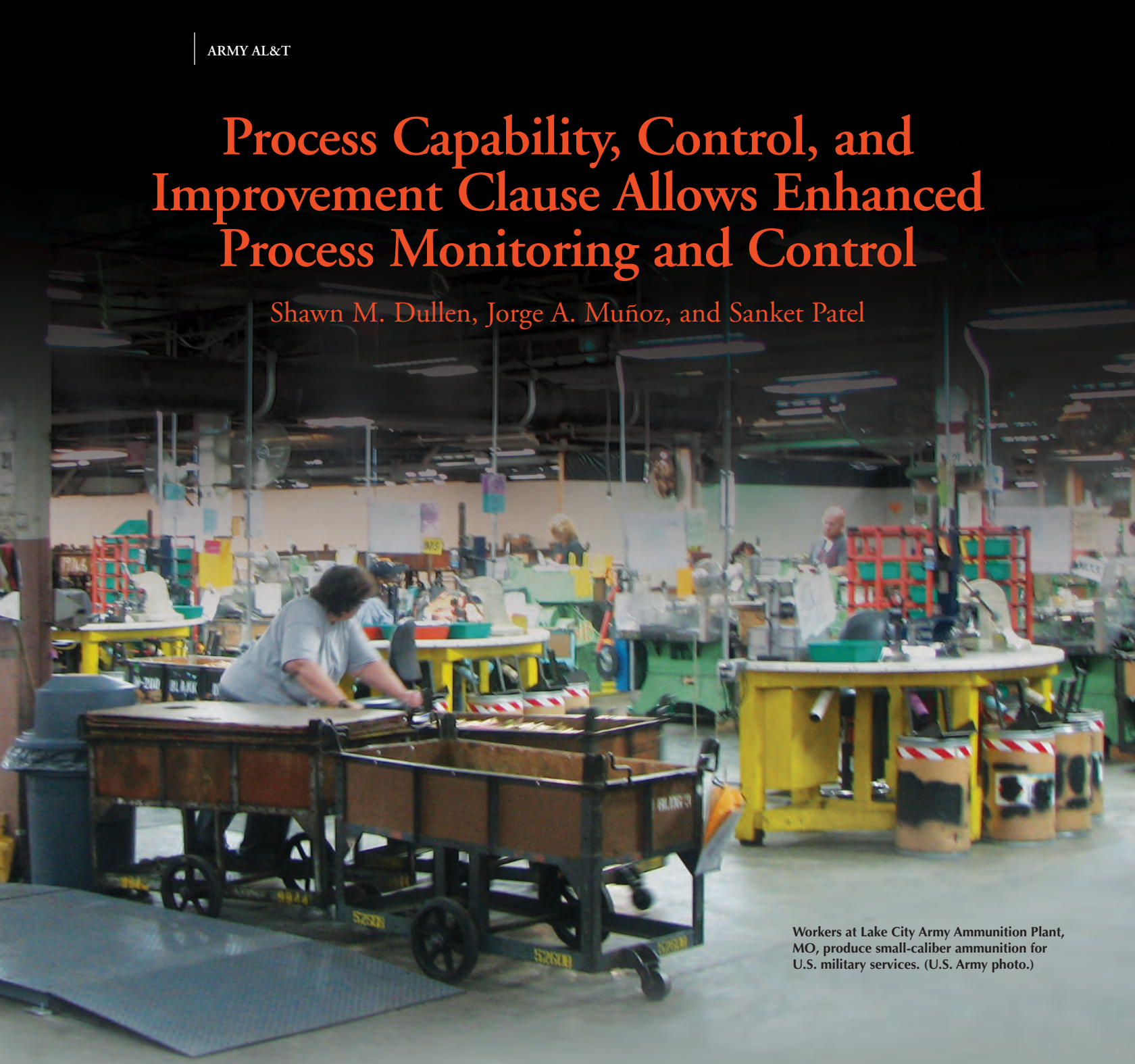


Workers at Lake City Army Ammunition Plant, MO, produce small-caliber ammunition for U.S. military services. (U.S. Army photo.)

The Supplier Quality Initiative Working Group has developed the Process Capability, Control, and Improvement (PCCI) Clause, replacing the Statistical Process Control (SPC) Clause. The PCCI Clause allows effective use of various process monitoring and control tools, as well as identification of specific characteristics for process control in lieu of all Critical and Major Characteristics that are outlined in specifications.

The PCCI Clause will provide a useful and straightforward tool for the Army's future acquisition strategies, with the desired clarity and flexibility of requirements for hundreds of DOD contractors.

The current SPC Clause requires the contractor to use SPC as a process-monitoring methodology. While SPC is valid, its requirements are outdated, as they mandate the use of a process-monitoring methodology but, unfortunately, do not provide a clear, holistic approach to process control. Hence, both the government and contractor have not reaped the benefits of a more robust process control approach.

This is the basis for PCCI: SPC will be only one kind of process monitoring methodology, and only specific characteristics will be identified for process analysis, monitoring, and control.

A Step Beyond Sampling

PCCI was developed via the Supplier Quality Initiative (SQI) program, described below, as a tool for use in ammunition acquisition and, when applicable, in conjunction with other supplier quality requirements. PCCI supports and reinforces the expectations of Military Standard (MIL-STD)-1916, *DOD Preferred Method for Acceptance of Product*.

PCCI requirements are intended to be uniform, integrated criteria for the Single Manager for Conventional Ammunition (SMCA) or other procuring agencies, to aid suppliers in accomplishing the following:

- Prevent defects.
- Perform manufacturing flow charting and process failure mode-and-effects analysis.
- Identify and assess process risks for characteristics for process control (CFPC).
- Determine process capability.
- Control processes.
- Initiate continuous improvement.
- Use commercial best practices.
- Interface with supplier Quality Management System and MIL-STD-1916.

PCCI was developed to manage the requirements of a large and diverse industrial base, various ammunition acquisition strategies, a diverse product portfolio, and associated quantities needed for the military. The clause also allows for program-unique applications.

PCCI is made up of seven paragraphs labeled "a" through "g," each with specific guidelines and instructions. It does not mandate the use of SPC unless specifically stated in paragraph "g" of the clause. Statistical methods are the preferred methodology for process monitoring. However, there are many methods to monitor and control a process; these requirements were developed to allow use of any method that can be supported by objective evidence.

The basis for these requirements is that sampling inspection alone does not control or improve quality. Product quality comes from robust product and process design and process control activities. When such activities are effective, sampling inspection may be redundant and an unnecessary cost. This clause requires contractors to develop process controls on identified processes and encourages continuous improvement in accordance with International Organization for Standardization (ISO) 9001:2008, *Quality management systems—Requirements*. The intended result is reduced or eliminated inspection, in accordance with MIL-STD-1916.

Supplier Quality Initiative

The purpose of SQI is to identify specific activities, processes, and projects for analysis and targeted improvement. SQI is an initiative of the Armament, Research, Development, and Engineering Center (ARDEC) and Joint Munitions Command (JMC), representing the joint munitions and lethality, Life Cycle Management Command, and SMCA community. Points of contact at ARDEC and JMC, respectively, are Christopher DeLima, Chief, Munitions Quality, Reliability, and Safety Engineering Division; and Gregory Zelnio, JMC Quality Director.

PCCI was established to address the application of quality assurance requirements, ensuring that supplier quality is managed in accordance with Army Regulation 702-11, *Army Quality Program*, with the goals of improving clarity of requirements; providing guidance on applying the requirements; and developing competency in the community (both government and contractor) to apply requirements consistently.

The organizations that make up the SQI are ARDEC, JMC, the Defense Contract Management Agency, Naval Air Systems Command, Naval Sea Systems Command, U.S. Marine Corps, U.S. Air Force, and program managers (PMs). PMs, who have

PCCI BENEFITS

Reduce Risk

Reduce Defects

Reduce Cost

Improve Quality

Maintain Scheduling

Continuously Improve

representation in the SQI Working Group, contributed to development of the PCCI Clause and are the offices that will implement the clause in their contracts.

SQI members meet on a regular basis to develop new initiatives addressing supplier quality issues, using various tools including Lean Six Sigma.

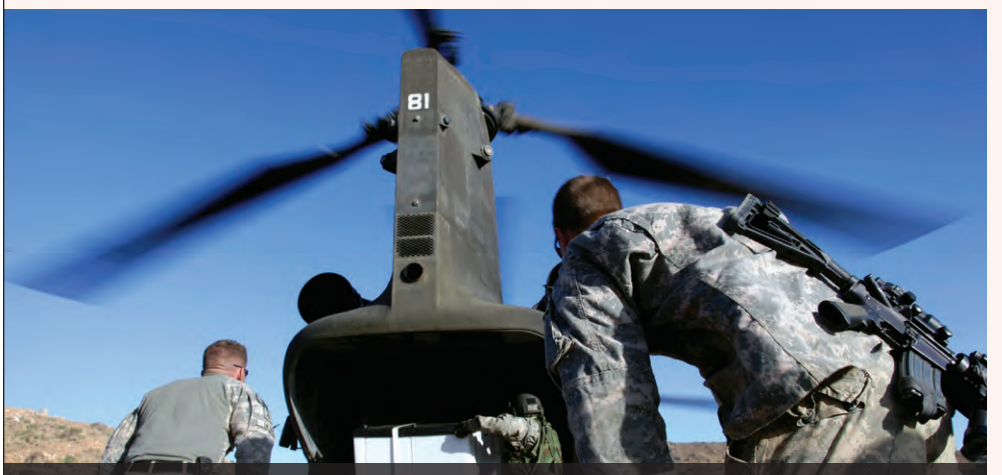
Refining Defect Prevention

The Army currently relies on use of SPC for all Critical and Major Characteristics identified in the Technical Data Package (TDP), as a "defect prevention" tool. However, this may become overwhelming and cost-prohibitive when specifications list literally hundreds of characteristics—for example, on complex munitions items such as an artillery fuze. On the other hand, for simple detail specifications (specs) such as those for Navy bombs and demolition items, selecting all Critical and Major Characteristics from the corresponding spec may be the best option.

These requirements do not, by themselves, adequately address performance specs and effective ways of identifying the most important characteristics for process control to prevent defects. PCCI was developed to address different kinds of situations along with corresponding "action plans," based on a set of options representing the most adequate acquisition strategy at hand.

The life cycle of ammunition is long and can extend decades in controlled storage, which is why periodic stockpile reliability assessments are made to ensure that the product has not degraded in reliability, safety, or performance. Therefore, it is crucial to reduce risk and defects by focusing on the appropriate characteristics, which will vary from one ammunition item to the next. For example, in mortar rounds, "ballistic performance" is a requirement. Misfires, early functions, duds, and other malfunctions are a subset of a ballistic performance requirement.

The Army acquisition strategy may vary depending upon the needs of the warfighter. To ensure that all potential acquisition paths are covered, it is important to select the vital CFPC that warrant attention. PCCI refers to characteristics that have a significant effect on fit, form, function, or safety as CFPC. The selected list will be based on TDP complexity, acquisition strategy, and item familiarity. This will focus the producer on implementing effective process controls on a leaner, more manageable set of CFPC, rather than applying SPC to all Critical and Major Characteristics.



PCCI was developed via the SQI program as a tool for use in ammunition acquisition and, when applicable, in conjunction with other supplier quality requirements. Here, Soldiers with Company D, 3rd Battalion, 509th Parachute Infantry Regiment, receive an ammunition resupply from a helicopter on Combat Outpost Cherkatah in the Khost province of Afghanistan, Nov. 26, 2009. (U.S. Army photo by SSG Andrew Smith.)

PCCI encourages process control and prevention rather than detection. It forms one of the four pillars of Supplier Quality, namely Prevention. The other pillars are the Critical Characteristics Clause, Quality Management System, and Acceptance Inspection Equipment for detection.

PCCI encourages suppliers to:

- Implement process controls in key areas identified as CFPC.
- Be proactive in identifying processes that have the potential for creating defects and, if necessary, modify those processes accordingly.
- Take advantage of reduced inspection requirements per MIL-STD-1916 if processes are stable, capable, and have been producing product without defect for a specific number of lots.

The purpose of PCCI is *not* to:

- Replace the Acceptance Inspection Equipment or critical characteristic requirements.
- Eliminate current inspection requirements per MIL-STD-1916.
- Require SPC on all CFPC.

Process Control Options

PCCI provides three mutually exclusive options for the required CFPC that need to be addressed. The option selected depends on the acquisition strategy and must be consistent with requirements of the SMCA members and their partners. It is essential that the military customers and offices responsible for acquisition have a consistent vision regarding implementation of the options within the clause.

The three options for identifying CFPC, and the appropriate circumstances, are detailed below.

Option 1: The government has a high degree of confidence in the accuracy and completeness of the TDP. This option requires the government to

SPC Anthony Zavala, an ammunition specialist with the 63rd Ordnance Company, 80th Ordnance Battalion, 15th Sustainment Brigade, 13th Sustainment Command (Expeditionary), loads belts of ammunition to be shipped to Afghanistan, March 11, 2010, at Joint Base Balad, Iraq. (U.S. Army photo by Naveed Ali Shah.)

list the CFPC in paragraph "g" of the clause for solicitation.

Option 2: The contractor must determine the number of CFPC using an in-depth review and analysis. The contractor will fulfill this requirement by providing all of the CFPC, with objective evidence, to the government for review and approval. Each CFPC will be clearly identified and explained. The government may identify additional CFPC deemed necessary in paragraph "g."

Option 2 is used primarily when the government does not own or maintain the TDP (for example, in a performance-based or commercial-off-the-shelf acquisition). This option may be applied when the TDP management duties are shared as well. Specifically, in a performance-based contract, the government may own the spec, while the contractor owns the drawings that meet the performance specification requirements.

Option 3: The government wants to partner with the contractor to identify the optimal set of CFPC. The focus of the analysis is safety, performance, and final cost impact of the features and processes. The analysis must take a systematic approach connecting warfighter requirements to design features and process capabilities. In paragraph "g," the government will provide a set of requirements to allow contractors to bid the tasks therein, as part of the proposal process.

Benefits of PCCI

Among the several benefits of PCCI, a key one is that development of the PCCI Clause has input from the supplier industrial base. On Aug. 24, 2010, an Industry Day was held at ARDEC. Various contractors were invited to discuss the details of the PCCI Clause and review guide.

The SQI team summarized all contractor comments and planned to update the clause, review guide, and accompanying training materials accordingly. The team has also prepared a PCCI review guide and training materials to instruct government and contractor personnel in the appropriate use of the PCCI Clause.

Another benefit is the scalability of process control requirements to best-fit TDP, acquisition strategy, and knowledge (the government's or contractor's). Education and process control are the focus. With the new PCCI Clause, SPC will not be mandated but can still be used as a process monitoring tool. Also, PCCI ties in to the Critical Characteristic Clause, MIL-STD-1916, and ISO 9001:2008. Finally, an SMCA-wide clause will be required to be implemented by all PMs; thus, it will be a standardized requirement.

Conclusion

PCCI encourages suppliers to truly understand the design, manufacturing, inspection, and materiel handling processes that will prompt them to develop and implement various kinds of effective process monitoring and control techniques.

The bottom line is that working cooperatively with the supplier in implementing and monitoring the PCCI Clause, and providing the necessary review guides and training, will help identify, manage, and reduce risk, thereby reducing defects. That, in turn, will help reduce cost, improve quality, maintain schedule, and contribute to continuous improvement.

PCCI will undoubtedly serve as a value-added tool for PMs and will ultimately lead to the best possible product to be delivered to the warfighter.

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